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ABSTRACT

This paper looks at the development and evaluation of an online learning and teaching package (http://www.herts.ac.uk/lis/ltdu/projects/mm2) in workshop techniques for Year 1 BA (Hons) Model Design students at the University of Hertfordshire (United Kingdom). Students produce as part of their coursework physical models made from such materials as wood, metal, and acrylic. "Workshop Techniques" was designed to complement the series of practical course sessions that familiarize students with the workshop machinery. It incorporates an online resource and testing facility to back up the practical "hands-on" lectures in the workshops. Machinery is demonstrated and the students get a practical introduction to using the equipment. Students must attend this practical and complete the online tests to be judged "competent" to use the machinery on their own at a later date. This paper outlines problems that have arisen from the traditional method of teaching the course. It then discusses the author's experimentation with a number of different teaching strategies, the first attempt which was to videotape the lectures. The next strategy was to present the material on the Web using a browser. The remainder of the paper discusses the design of the package, its applications, and the benefits of the feedback from student evaluations. (AEF)

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"Evaluating the student Experience of Learning On-line."

Ashley Pinn

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This paper will look at the Development and Evaluation of an On-line learning and teaching package in workshop techniques for students at the University of Hertfordshire. The package case studied, "Workshop Techniques", is available on-line for viewing: -

http://www.herts.ac.uk/lis/ltdu/projects/mm2

This paper will address lessons that can be drawn from students working on-line using the "Workshop Techniques" package. It discusses 3000 test results and how student evaluations can improve teaching.
I intend splitting this paper into three parts. The first will be an overview of the context of "Workshop Techniques". The second on how the programme works from the student user point of view and the third on the evaluation process and how we as teaching professionals can learn from the students' differing learning styles to feedback & improve our teaching methods.

Year 1 BA (Hons) Model Design students at the Faculty of Art & Design, University of Hertfordshire use "Workshop Techniques". This scheme, one of the premier schemes in Europe in this discipline, teaches students the practical skills necessary to gain employment in one of the following fields, product, architecture & special effects modelmaking. The students produce as part of their coursework physical models made from such material as wood, metal and acrylic.

A. Pinn

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"Workshop Techniques" is an integral part of the first practical course the students participate in when they arrive. This course comprises a series of sessions to familiarize the students with the workshop machinery that they will have to be able to use to complete their projects later in the course. "Workshop techniques" was designed to complement these practical sessions. It incorporates an On-line resource & testing facility to back up the practical "hands-on" lectures in the Workshops. Machinery is demonstrated and students get a practical taste of using the equipment. Students have to attend this practical and complete the on-line tests to be judged "competent" to use the machinery on their own at a later date.

The traditional method in teaching students craft skills, particularly workshop and manufacturing processes in the field of Art & Design (such as Modelmaking) and related disciplines is one that is probably familiar to

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all of you teaching practical subjects such as this. In the workshop skills sessions for example, they have followed a set pattern. For each machine in our workshop (there are currently about 60 different machines) students attend a lecture demonstration. A lecturer such as myself with technician support gives this. The students are divided into 3 or more small groups of about 16 -18. The session starts by the Lecturer giving a demonstration of the safe working of the machine as well as describing its parts and their function. During this stage the students take notes from which to study later, these are useful if they do not operate that particular machine for some time after the lecture and aides their memory on what to do when they approach the machine at a later date.

The second part of the session involves the students given a set task and in small groups, set up the machine and use it to produce an exercise piece each. For example, on a centre lathe each student turns up specific shapes using techniques learned during the lecture demonstration. Reinforcing their learning by doing it themselves at the end of the practical session each student thereby produces a simple artifact on the machine. They then leave and apart from a competence test which they have to pass, which is a written test on simple health and safety issues, they can use that machine on their own when they next come to the workshop to manufacture a model.

The above two stages of a typical 1.5-hour session are pretty much how we have been teaching workshop skills for the last ten years. While being successful in initially imparting techniques for using machines, the format is not so successful in keeping the knowledge in the forefront of students minds, particularly when they may not use that particular machine for some months . After the initial lecture/demonstration session, the student then has to rely on the notes they have taken during the session. If they prove to be inadequate the only recourse they have is to ask for assistance in setting up from either one of the technical staff or the lecturer (usually me!)

In addition problems always arise with the method outlined above in so much that in any large group of students, some will always miss the initial lecture. Some of the reasons why they do can be quite valid - such as being ill on the day. Sometimes the students are just absent. (Probably surfing the Net!). This however creates a problem for the University. To be covered in terms of insurance each student has to have received instructions on the safe operation of the machines. If they missed one lecture E.g. Milling machine. I have to repeat this lecture/demo session just for them. This is inherently wasteful in terms of

resources, giving one to one tuition to a student for an hour & a half is frowned upon in the current economic climate.

Indeed doing this extra session for the student deprives the other 50+ students in that year group of my time whilst I am demonstrating. From the lecturers point of view this repeating of essential information to students who have missed it is boring, The teaching and non-teaching staff at the University have being trying for a considerable time to resolve this problem, of what to do with students who in the first case missed the introductory lecture. They could be given a "fast track" set up session by a member of the technical staff, this taking about 15 to 20 minutes immediately prior to the student starting work on the machine. However this is in no way as comprehensive as the taught session by the lecturer. It also runs into our perennial problem of whether Technical staff can be classed as "teaching" rather than demonstrating to students. This grey area can run into problems with role definition and job description. I attempted to find solutions to this problem , in order to give the students a better learning experience as well as addressing the staff time issue.

To begin to tackle this problem I decided to experiment with a number of different teaching strategies. The first attempt being made by videoing the lectures . This was a partial solution, the lectures were taped from a single standpoint to begin with and the recorder was allowed to run live throughout the lecture. No change of viewpoint was used nor were there any cuts or close-ups. It was just a tape of the lecture. This was useful, as it allowed the student to have an overview of what they missed. However unless we spent a lot of money in terms of staff time setting up a "proper" TV style presentation of a particular machine, with close-ups , changes of camera angle and a specific narrative, it could not take the place of the initial lecture and the student still required the "fast-track set up" briefing before they started work.

It was felt that taping the lectures was worthwhile in itself as it was found that when a student was asked to watch a video and take notes. They took in a fair amount of the information on the tape. This enabled us to ask the student to set up the machine when they wanted to use it and then check them, to see if what they had learned from the video was enough to safely prepare the machine for use. This was successful as the student could set up the machine without assistance using the knowledge gained from the video and only call staff over when they were ready to begin work. The time the member of staff was with them was reduced (by

70%) as the student had completed most of the work themselves.

This video trial was continued and each lecture was put onto tape. They are now in our library. There are 6 or 7, 3-hour tapes that the students can borrow or look at on site. The video system was not perfect however e.g. As each 1.5 - 2 hour lecture is recorded live on the tape and there are probably 5 or 6 lectures on different machines per tape. It was quite difficult for the viewer to fast forward through the whole lecture to find information on: for example, use of the dividing head in the Milling machine lecture. We tried indexing the tapes but as the viewpoint for each was constant throughout it was very difficult to glean information about a specific topic (within the lecture) without fast-forwarding through the lot. However it was still better than nothing as an aide memoir. I was still unhappy with the overall quality of the images (VHS - standard quality) and the fact that unless I wanted to commit a whole lot more time & money the viewpoint was fixed and no close ups were possible. I continued to look around for a better way of presenting the information.

I also teach several sessions on computers, mainly for the special effects course where we use Adobe Photoshop to composite a model with a "real" background. The students are encouraged to use a variety of different packages in their work. I also noticed that students today are totally familiar with and use computers not only for their work at University but also as a hobby /relaxation tool. They surf the Net and use computer games like veterans. With this modern culture of hi-tech equipment & imagery evident in the students interest, I was interested to see if I could tap into this latent experience of Hi-tech gizmo's that the students are exposed to: For example the cinema & computer-games. How could this experience assist me in teaching a pretty dry and what almost could be said to be "traditional" technique of using woodwork and metalwork machinery to machine wood and metal to make physical artifacts.

Although this is fun in itself it can look old and boring in the hi-technology world we live in. It is much more fun for the student of today to keep themselves clean, pushing buttons, this being in some strange way more "glamorous" than physically making something on a lathe. Where there could be a danger of them not only being hurt by an error on their part but heaven forbid even worse, getting their designer clothing contaminated with wood chippings, Oil and swarf!

At that time I was writing pamphlets and course notes for the PhotoShop course & workshop skills machinery courses I was teaching, as well as the use of the World Wide Web for gathering

information. I hit on the idea of using the Netscape page and its ability to follow links and scroll down in a document, to make reading of documents simpler and more fun than a simple photocopied handout.

By using Netscape I made the whole system of imparting information much more interesting and "Fun". I could also include Photographs in close up of the machine, showing particular operations as well as explanatory diagrams and illustrations. I put together some sample pages and put in a bid for funds from our Learning Technology Development Unit. (LTDU) I was successful in obtaining funding and proceeded to put together the finalized "Workshop Techniques" package.

Presenting the material on the web using a browser was a stroke of genius. It tapped into the students' latent interest in anything remotely technological. Using the Internet and following links on a page is becoming a key skill as well, with 35% of adults regularly using the WWW not only for work but also for recreation enjoyment. Not only were the pages indexed so those students could refer back to what they were looking at previously, but also it was much clearer then scrolling through an entire videotape. The pages were divided into sections for ease of use with a page on each machine as well as linked pages on e.g. Operation, Health and Safety tips Etc.

Students familiar with the keyboard skills and using the Net to "surf" for information as well as a recreational facility can use the net to surf through the information in the package. By following the links they can also take in as much information as I can give them. In the case of the student who has totally missed the lecture they would have to follow all the links telling them all about the machine and its attachments. A student however who had attended the initial lecture who only wanted information on one particular aspect could skip through most of the pages and links to gain the specific information that they wanted.

Once I had secured funding to proceed with the project I started work in the summer of 1998. The first thing I realized was the enormous amount of work I had undertaken to do, in terms of generating the text and in addition posing and taking over 450 images of various machines. The package was originally put together using Dreamweaver 1.0. This resulted in a non-frames version. It was divided up into sections, each section covered setting up and using each machine. The emphasis being placed on health & safety issues, with separate sections dealing with safety equipment such as masks and goggles. I made the decision to incorporate

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on-line testing to reinforce what the students had learned in reading the initial "Tutorial" part of the package. As the key aim of the package was to ensure that students who had missed the initial lecture had remembered sufficient information from the "tutorials" section so that they could this information to good use when they came down to the workshop to use a machine for the first time.

After some initial development using the non-frames version it was decided that due to the learning content covering the usage of ten machines and the high density of images, a frameset structure was adopted. This allowed me to conceive a structure whereby the navigation buttons (e.g. options to choose machine type, test section etc.) would be permanently on display to the user and be accessed at any point throughout the material - even during the test section. Thus the nature of the project altered from one in which the test sections were to be placed and accessed at specific points within the material to one where the questions could be accessed freely.

This frame based approach provided an "open" learning environment and suited the requirements of the project in that the students were able to test their current knowledge of the subject whenever they wished and thus gained some sense of their progress.

At the outset of the project it wasn't totally clear what software would be used to create the assessment sections. The public domain package *Web Course in a Box* was tested and seemed to be adequate to the task but only seemed capable of multiple choice single answer questions, or fill in the blanks sentences. The *Castle* project was also inspected, but this, like *Web Course in a Box*, had most of the marking undertaken at the server side. As the demand had arisen for distribution by CD-ROM as well as over the web, specifically for colleagues in the USA, we needed something, which would also function on the client side alone if possible.

Moreover, we wanted something whose look and feel would be entirely controllable by other developers and myself in order that its questions could be seamlessly embedded in a teaching package. In the end therefore, LTDU developed its own question authoring system, the *Question Generator* which could produce the complete test in the form of a single html file. Results from students sitting the test were sent to me as emails via a CGI script on the University of Hertfordshire's web server: however, even if the person using the system had no web connection and used a CD-ROM, the quizzes could still be used for self assessment purposes.

The *Question Generator* works by the author writing the questions on a web form, following a simple syntax which are then posted to a cgi-script which returns an HTML page with the quiz encoded within it in javascript. Once this was done, we would then incorporate the resulting quizzes into a frameset template using Macromedia Dreamweaver. The final test page would be nested as a secondary frameset within a parent frameset, (which displays the navigation buttons). A typical test section took approximately 1 hour to produce.

A general point to be made here is that *flexibility-of-deployment* needs to be a very important consideration when using any kind of computerised assessment. The number of possible contexts in which one may wish to which is not too exigent in terms of look and feel, and precludes as little as possible in the areas of customisation and modifiability is to be preferred.

Each test section produces an overall score and a summary of the results for each question. On the basis of the scores the student can decide whether they are able to move on to study another machine or should re-visit certain sections. The score is used as a means of determining the students' direction of learning through the package. In this way Workshop Techniques is responding to the students misconceptions of the topic and redressing them by indicating the areas of the topic which the student is weak in and should re-consider. The use of diagnostic testing for directive study enables a class of students to come to a common learning point within the course material regardless of either their ability or prior knowledge of the subject.

After completing the test the student would submit their answer to the program for scoring. At the same time a total score along with the time at which the test was taken is forwarded by email to me. This serves a number of purposes: first I can actually see if the package is being used at all; second I can gain an idea which students are actually using the program and who are not and thirdly they can monitor the score for the whole class. If I find that the class appears to be struggling I can arrange for extra tuition in the form of revision lectures and practicals.

The use of embedded testing within Workshop Techniques lends itself to three types of usage:

First the embedded test along with the rest of the application forms part of an integrated course where Workshop Techniques is supported by the more traditional lecture and practical. In this context the application acts the concepts introduced within the lecture.

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Second the application is used as a means of determining the gaps within the knowledge of students who have either missed the practical / lecture sessions or who are struggling with the course content. From the student's test scores I can see in what areas of the course the student is having problems with and determine whether the student does indeed have to attend a practical and if so the length and extent of the session. In this context I am able to determine the degree of traditional support appropriate to the student's needs. The presence of overseas students within the course has been steadily increasing over the last few years with many individuals seeking placement beyond the first year. Under these circumstances Workshop Techniques is used within an "interview" context whereby the eligibility of the student to enter either the second or third year of the course is ascertained. On the basis of the test scores the staff can decide whether the student can be moved up and if so what type of additional support they may require.

At this point I would like to point out that all these tests are not looked upon by me as being in the same league as a formal examination, with all the issues such as security to be addressed. As the entire point of the "Workshop Techniques" is to concentrate on imparting health & safety information, I am quite happy if the students keep referring back to the tutorials whilst doing the test as well as asking each other questions whilst sitting together on workstations. In any event I have yet to come across a system where the teaching staff are absolutely sure that submitted work in any format e.g. essay has been written by the student submitting it, or come to that downloaded it off the internet!

Now that the "Workshop Techniques" package has been up and running since 1998. I turned my attention to evaluating its performance and how the students' evaluation of it as a teaching method can be used to affect the future shape of this and other web based methods of instruction.

Evaluation of "Workshop Techniques" has been gleaned from principal sources. First was the actual e-mail test results sent to my PC. This gave a list of the questions answered but also how many tries the student had taken to get the answer correct. These e-mails also recorded the time of day the student hit the "submit" button to send the test on. As an additional by product of the test. The student had to fill in their name and e-mail address in the relevant boxes-this meant that immediately I had a full list of all the participating students' e-mail addresses. A task that can take many hours if requested orally in the class environment!

The second source of information was from the Universities own web server. This gave information on how many hits each page had received and at what time of day. From this you could deduce which pages were the most popular and also which order they were accessed. You could also

find out if the students referred back to the relevant pages of the tutorial sections whilst looking at particular tests. In essence, this allowed individual students' progress through the package to be mapped if required.

The final source of data was an in-built evaluation questionnaire built into the package as an integral link. This is under the link "feedback". This has been used by the students as well as outside contacts as a form of peer-review. It covers such areas as what type of computer and browser the user is using to access it. As well as specific questions about the way in which a particular student accessed the information. Importantly it asked the student how familiar they were with navigating through teaching packages such as this, as well as their level of computer literacy.

Because use of the package was an in-built part of a course, take-up by students was very high. Some 90% of the class used the package, particularly the tests. Use of the tests has resulted in the generation of over 3,000 e-mail responses to date. What was unexpected was the amount of time each individual student spent on using the package. Figures of 7 to 8 hours were not uncommon. The number of hits the pages got at different times of day was also interesting. The largest number of hits was recorded between midnight and 1am and Sunday afternoons between about 2.30pm and 4 O'clock. This was surprising as prior to the package being developed students only attended a 1.5-hour lecture/demonstration and did a simple multiple choice test based on a slide presentation.

One of the most encouraging things when developing on-line applications is this kind of tangible feedback one can get about one's teaching and materials. When you see all the e-mail coming in, detailing one's students' understanding of the materials, as well as more interesting findings of the kind described above, it rewards all the effort you put in. In this particular case, the instant feedback from tests had many uses: you could immediately see whether a student was competent to be able to use the machines on their own. This was valuable for the faculty (as mentioned previously) because Health & Safety requirements demanded that each student was deemed to be competent to use the machinery. Instead of long- winded tests in a lecture setting (which had to be physically marked) the package instantly told me the percentage each student got right on each test straightaway. So, there was no lead-time between the student taking the test and being documented as having passed (or failed) the test.

Initial findings have also discovered a range of learning styles employed by the students in how they navigated around the information provided. Different learning styles have become apparent. These differences in approach have in turn fed back into the development of the package in terms of navigational references and other link based paths. These

differences in learning style have included students who started the project and followed it through methodically from start to finish. Others used a much more pick and mix approach, repeating some sections, and ignoring others. The on-line assessment was also accessed directly by other students who only used the tutorial sections after they had completed the tests. The most significant was the fact some students learning style involved accessing the package on a 24 hour learning basis. A point that I had not anticipated at first when I first came up with the idea of "Workshop Techniques". I have had examples of students submitting test results between 3 and 4am!

Ashley Pinn July 2000

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